

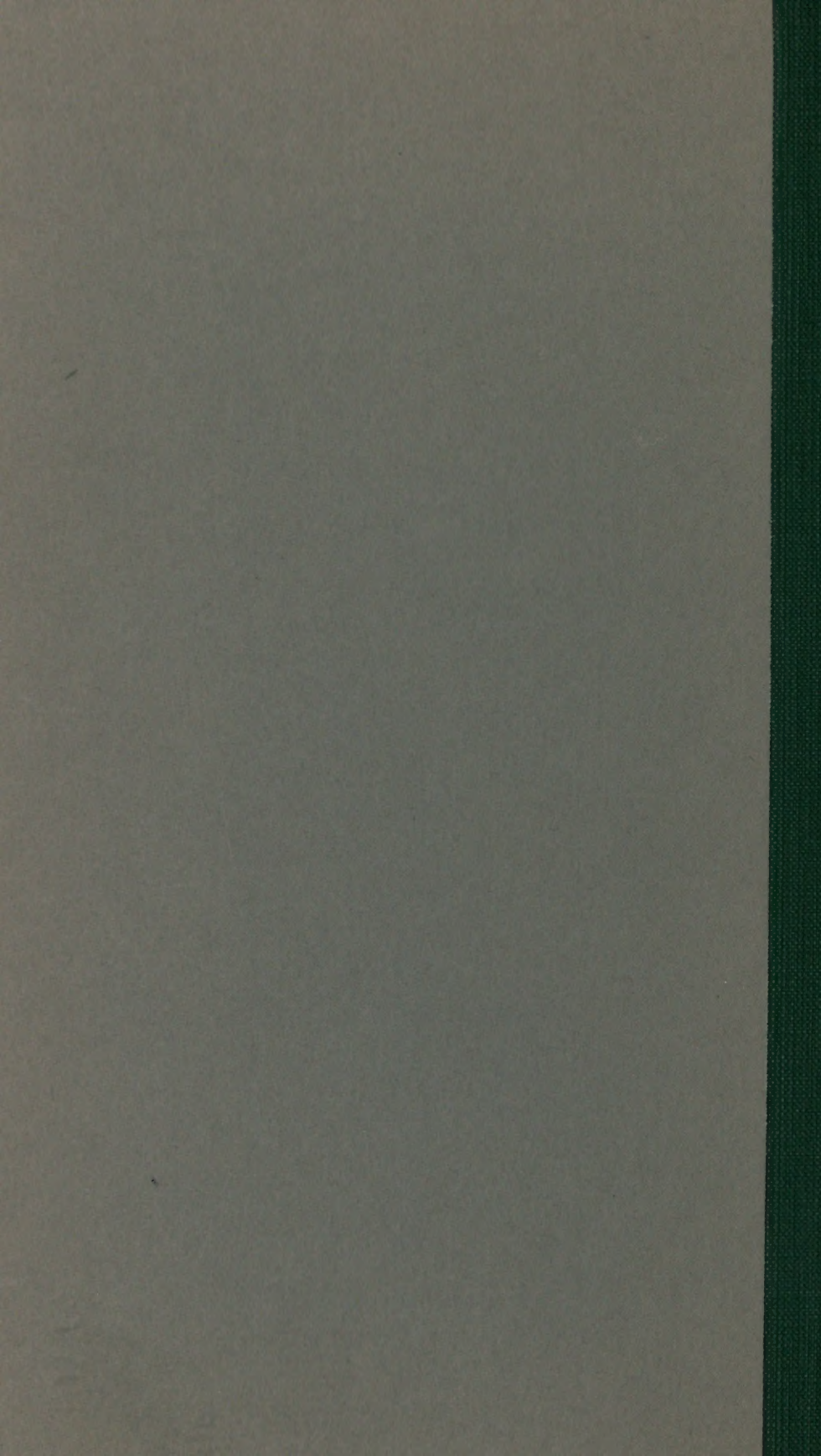


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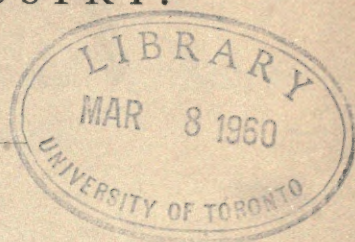
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National Council of the
Pottery Industry
Interim report



NATIONAL COUNCIL
OF THE
POTTERY INDUSTRY.



Interim Report

ON THE

Construction and Ventilation

— OF —

Potters' Drying Stoves.

JANUARY, 1920.

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E4N3

NATIONAL COUNCIL OF THE POTTERY INDUSTRY.

Research, Inventions and Designs Committee.

Interim Report on Construction and Ventilation of Potters' Drying Stoves.

GENERAL PRINCIPLES.

1. The main points to be aimed at in the construction and arrangement of a potters' stove may be set out as follows :—
 - (a) A constant current of hot and comparatively dry air passing round the moulds and ware in every part of the stove.
 - (b) The provision of inlets and outlets in such positions and of such natures as to ensure this circulation, with the constant supply of "dry" air and the removal of the "moist" air, and the prevention of any flow of air from the stove into the workshop.
 - (c) The means of regulating the temperature and rate of flow of the air.
 - (d) The means of placing the moulds and ware in the stove and of withdrawing them without the workers themselves passing in and out of the stove.
2. Many of the Potters' Stoves now in use do not fulfil these conditions ; they are generally wasteful of heat and a source of discomfort and even ill-health to the workers, and it may be well to mention a few elementary points in this connection.
3. The ordinary atmosphere contains always a certain percentage of moisture but it is capable of holding only a definite maximum amount at a given temperature. The maximum amount increases as the temperature is raised and decreases as the temperature is lowered, so that the simplest means of increasing its capacity for taking up and holding moisture is to raise its temperature, thus making the air comparatively dry. It is evident that if the air contains its maximum percentage of moisture, *i.e.*, if it is saturated with moisture, it cannot take up more moisture from the moulds and ware and no drying can take place. Now the air is often saturated with moisture and hence it is desirable that the air should be heated before it comes in contact with the ware.

This can most readily be done by passing the air over steam pipes either before or immediately after it enters the stove, and air entering should be so regulated that it is all sufficiently heated and rightly distributed throughout the stove. It will be further evident that as the "dry" air takes up the moisture from the ware it will itself become moist and finally saturated, and that before it reaches this latter point it is essential that the air should be removed from the stove. For this purpose sufficient ventilating shafts should be provided.

4. In many cases these outlets are either insufficient in area or unsuitable in arrangement, but care should be taken in applying fan suction to the outlet ducts as it is possible to draw too much air through the stove for efficient working as the air would not have time to become sufficiently warm by contact with the hot pipes, and so when near the saturation point on entering it would not possess sufficient drying power for its purpose. If on the other hand, the air was comparatively dry on entering, the drying might be too rapid for safety if the current of air was too powerful.

Report of Visits.

5. The Sub-Committee appointed to visit and report on existing types of Drying Stoves inspected 11 factories, including

4 China Works,
6 Earthenware Works,
1 Glue Factory.

At each of the potteries visited, a careful investigation was made of the various means employed to comply with Regulation 9 (c) of the Pottery Regulations, which provides that—

"All drying stoves shall be ventilated direct to the outside air by shafts having upward inclinations and terminating vertically, or by louvres in the roof, or by other effective means."

6. The general opinion formed as to all the older types of potters' stoves, whether of the chamber or dobbin type, is that they are very far from ideal, because
 - (a) They are difficult to ventilate sufficiently to carry off the moist hot air directly to the outer atmosphere without mingling with the air of adjoining workrooms, and
 - (b) They are very wasteful in the way the heat supplied to them is utilized in the drying of moulds and ware.
 - (c) They are generally uneconomical in space.

These objections, however, apply only in a very limited degree to well-fitted dobbin stoves properly maintained.

7. Chamber stoves heated by a stove-pot are on the whole better ventilated than steam-heated stoves, because the fire in the stove.

pot requires a large amount of air for combustion purposes and accordingly serves as an automatic ventilator. In such stoves an outlet from the top of the stove with a duct leading into the chimney will produce good results.

8. The drawbacks noted in paragraph 6 above appear to be inseparable from any type of stove in which relatively large entrances to the interior of the stove are necessarily left open for substantial periods of time, as is the case where doors must be kept open during working hours. Cold air entering by such doors is not first dried and warmed by contact with the steam-pipes, and consequently the major drying effect is that due to radiation and convection from the pipes; this entails a much greater amount of pipe-heating than would be the case if the entering air could be drawn in from under or past the heating battery. Moreover, the rapid warming of the cold air at the moment of entering the hot stove causes a considerable expansion and only very efficient ventilation will deal with this expanded air rapidly enough to prevent a back-draught into the workroom from the upper part of the open stove door. (NOTE—This expansion difficulty can probably be largely overcome by providing means for expanding upwards. See paragraphs 18 and 19 below).

9. As a necessary corollary to the last paragraph above, it seems to follow that exhaust fans to draw out the hot moist air from the usual type of potters' stove can only be usefully applied to a very limited extent; if the capacity of the exhaust fans is sufficient to deal adequately with the amount of "used" air to be removed, an entirely excessive amount of cold air will be drawn in through doors and openings (where it is not dried or warmed on entering) and the drying value of the stove will be greatly reduced.

10. This must not be taken to imply any justification of the old prejudice, still occasionally met with, in favour of unventilated (of much under-ventilated) stoves: these are undoubtedly as inefficient for drying as they are unhealthy for the workers. While quantities of humid air pour out of such stoves into the workrooms, a great deal of air highly charged with moisture collects in the stoves themselves and **impedes** drying.

11. There is, however, as stated in paragraph 9, a limit beyond which it is not practicable to draw fresh air into the stoves unless this entering air is first warmed and dried. Accordingly it does not appear possible, in the type of stove generally in use, to apply exhaust fans so as to secure greater efficiency than is possible with ample natural ventilation. A small chamber, moderately heated, can generally be adequately ventilated by a vertical shaft of 12 to 15 inches diameter carried straight up through the roof, and properly safeguarded against down-draughts due to high winds. Where structural conditions render it difficult to carry a wide shaft straight up through the roof from each stove, it will of course still be advantageous to utilize exhaust fans to produce a similar effect. The Committee cannot, however, point to any instances in which exhaust fans have been applied to the ordinary

type of potters' stove with results markedly more efficient than those achieved with the freest natural ventilation.

Recommendations.

12. The Committee are therefore emphatically of opinion that all new stoves should be constructed on a different principle to the old stoves which show such narrow limits of efficiency. Moreover, on the efficiency of new types coming to be established in practice, the old types should be replaced as rapidly as possible.
13. **All new stoves should be**, as far as possible, **of the totally enclosed type**—sometimes called the “cabinet” type. In these, provision is made that as small a door (or doors) as possible should be open at any one time, and the period during which such doors are open should be as short as possible. Normally, therefore, all the air entering the stove will come up through or round the heating-pipes and so be warmed and dried before it reaches the moulds and ware; the “used” air can then be extracted from the stove—either by natural means or by fans—as rapidly as may be found desirable to secure the two desiderata, viz. :—
 - (a) Prevention of back-draughts of “used” air into the work-rooms.
 - (b) Promotion of efficient drying.
14. The best adaptation of the cabinet system to china-casting work was seen—not quite completed—at Messrs. A. B. Jones & Sons, Grafton Works, Longton, where a moderate-sized cabinet with a number of small doors has been so designed as to afford ample drying accommodation for some 30 casters. In this case the stove is divided into a number of small compartments each of which is fitted with a sliding door (on the sash principle) so that the ware can be placed in and withdrawn from the stove without the workers passing in and out of the stove.*
15. A cabinet similar to that referred to in the last paragraph would not provide sufficient drying space for the average earthenware making shop. Accordingly the Committee regard the draw-out stove (in which each section draws out separately into the work-room like a laundry drying stove) as the best solution of the problem in earthenware work. Such a stove may be seen at work at Messrs. Josiah Wedgwood & Sons, Ltd., Etruria. The stove occupies the centre of the Potters' shop and is heated by steam pipes laid along the floor and fitted with ventilating shafts running up through the roof. The ware is placed on stillages which are framed in sets or dobbins which run on rails or runaways and which when full are pushed over the steam pipes. These dobbins

*A similar arrangement is in use in a number of tile works in Germany where the drying stillages are all enclosed and fitted with a series of small doors which allow access to only a few stillages at a time. In some cases the drying of the ware was accomplished by means of warm air which was drawn by a fan from the cooling ovens and distributed through gratings in the floor under the stillages by means of pipes and ducts. This seemed to be a very efficient means of drying, but could be only adopted on works where there were constantly two ovens in different stages of cooling.

fit side by side and occupy the whole space of the stove, and when the ware is dry they can be pulled out like a drawer and emptied and refilled without interfering with the general arrangement and working of the stove in any way. This stove seems to fulfil all the requirements set out in this memorandum and the Committee most strongly recommend its adoption wherever practicable. It would not be suitable where it is necessary to have hot moulds,[†] but for all other purposes it might be adopted with very great advantage both as regards economy and efficiency in working and the health of the workers.

16. Although the Committee regard enclosed types of stove (such as those referred to in paragraphs 14 and 15) as so much more efficient than any of the older types, they feel that—pending re-building of existing stoves—it should be possible to effect great improvements in some of the present dobbins and leaf-stoves.
17. In the first place, attention should be given to closing up as completely as possible all unnecessary and accidental openings into the stove, whereby unwarmed and undried air will be drawn in : such unnecessary openings are nearly always to be found at the foot and at the top of the section open to the workroom, as well as at the edges of the dobbins or leaves. If all these spaces are closed as far as possible and the moving parts kept running with the minimum of safe clearance from the fixed parts, much more extraction ventilation can be applied and the equivalent amount of fresh air will be drawn into the stoves from under and around the heating pipes, provided that a sufficient number of inlets are arranged under the pipes ; where necessary the heating efficiency can be greatly increased by placing a gill-pipe in each such inlet.
18. The second most important improvement consists in raising the tops of the stoves as far as practicable ; the great majority of stoves are to-day finished off by a flat top which impedes any free upward ventilation, even where an outlet shaft goes straight up from the middle of this top. An immense improvement can be effected, for example, in a top-floor stove placed immediately under a gable roof, by removing the top of the stove and building the sides right up to the principals or purlins of the roof ; the “used” air then collects in the big open space above the stove and trickles out steadily through the louvres or other outlets provided in the apex of the roof.
19. Where such a space is provided over the top of the stove and the openings in the roof are of ample dimensions, it has been found in practice that the back-draught due to rapid expansion of the cold air entering at doors (referred to in par. 8) can be completely overcome. In the opinion of this Committee no stove can be regarded as efficiently ventilated in accordance with Regulation 9c of the Pottery Regulations unless “back-draught” from the stove into the workroom is practically eliminated.
20. In all stoves where the worker has to walk over steam pipes

[†] In this case the cabinet type described in paragraph 14 can be adopted quite satisfactorily.

some permanent wooden lath protection should be provided to obviate the necessity of the use of loose walk-boards, the placing down of which is a source of dust and therefore of danger to the workers.

21. Attention should be given to the need for adjusting the heating of various potters' stoves to the particular requirements of different classes of ware made. Where more than one class of ware is made in the same shop, the heating of each section of the stove should be separately regulated and the steam-valves placed under the control of the makers.
22. Although in the great majority of cases totally enclosed drying-stoves are applicable and most desirable, there may still be certain branches in which special articles are necessarily left to dry in the workroom instead of being removed to a separate stove. In such cases, Reg. 9 (b) of the Pottery Regulations applies, viz. :—

“All workrooms in which articles are left to dry shall be ventilated in such a way as to ensure a continuous movement of the air in the room in a direction away from the workers and towards the articles in question.”

23. The continuous movement required by this Regulation can be readily secured by a properly designed fan installation, consisting of

- (1) An exhaust fan drawing out from the room at or near the floor-level on the side of the room furthest from the workers, *i.e.*, behind the drying ware, and
- (2) Hopper inlets, 7 feet or so up, on the opposite side of the room admitting fresh air at a low velocity and at a suitable temperature.

In all such installations, it must be borne in mind

- (a) That fans will not exhaust efficiently if proper provision is not made for admitting fresh air to replace the “used” air extracted, and
- (b) That rooms will get cold in Winter, and draughts will also arise, if the entering air is not warmed, *e.g.*, by a gill-pipe in each hopper inlet.

Given due attention to these points, the air of a room can be very efficiently “scavenged,” without a trace of cold draught, etc.

24. The Committee wish to acknowledge its indebtedness to Messrs. Josiah Wedgwood & Sons, Ltd., Messrs. A. B. Jones & Sons, and other Manufacturers who were kind enough to allow the Committee to inspect their stoves, and who placed all available information at its disposal.

NATIONAL COUNCIL
OF THE
POTTERY INDUSTRY.

SECOND

Interim Report

ON THE

Construction and Ventilation

— OF —

Potters' Drying Stoves.

JANUARY, 1923.

NATIONAL COUNCIL OF THE POTTERY INDUSTRY.

Research, Inventions and Designs Committee.

Second Interim Report on the Construction and Ventilation of Potters' Drying Stoves.

Adopted by the National Council, 11th January, 1923.

1. Since the publication of the First Interim Report in January, 1920, the Committee has continued its investigations into the Construction and Ventilation of Potters' Drying Stoves and has studied several new types of Potters' Stoves which have been recently introduced. These Stoves have been constructed in the main in conformity with the general principles laid down in that Report. The most noteworthy development has been achieved on the lines of the Dippers' Mangle; two distinct types of this class are now in use; the simpler type, where the ordinary mangle principle has been directly applied, has been adopted by Messrs. Poole, of Longton. In their case, a small tower mangle has been installed for the use of saucer makers, each section being separately worked by hand-gear. The same principle has been also adopted, but with very considerable modifications, in the drying stove introduced by Messrs. Wood & Goldstraw. In this case the movement of the shelves carrying the ware is approximately circular, the drying chamber being practically cubical in its dimensions. In this latter case, a series of shelves are slung together so as to greatly economise space, and the supporting pivots are carried on large sprocket wheels without chains.
2. In both these cases the Drying Chamber is completely enclosed. with the exception of a small opening through which ware is placed on to or removed from the shelves; the shelves themselves are successively brought into a stationary position at the most convenient height for the mould runner. Both these types seem very efficient and meet all the conditions laid down in the First Report as desirable in stove construction. Messrs. Poole's type is suitable for narrow shops with ample head room. Messrs. Wood & Goldstraw's may be used where head room is very limited, but it occupies a somewhat greater width of floor.
3. The Committee very strongly recommends Pottery Manufacturers to consider one or other of these types of stove in any alterations or rebuilding of stoves which they may contemplate.

4. The whole of the investigations made by the members of the Committee have proved conclusively to their satisfaction the ill-effects of defective stoves on the health conditions of the working potter. It is, therefore, of the utmost importance that every effort should be made to instal a type of stove, which, whilst efficient from the point of view of drying, is also satisfactory from the point of view of the health of the worker.
5. From this standpoint, it is necessary that the closest attention should be given to preventing the hot humid air of the stoves from finding its way into the workshops, and so giving rise to the high temperature and injuriously humid atmosphere so often found in potters' shops.
6. It has been noted with great satisfaction that increased interest has been displayed in many potteries in the problem of maintaining efficient ventilation in drying stoves. The proper working of a stove depends on the maintenance of a more or less complicated series of air movements and it is quite possible that this may be interfered with by such accidental circumstances as the opening of a door of the potting shop opposite the entrance to a stove; once disturbed, the proper flow of the air currents is not always easily restored. It is, therefore, very desirable that the officials in charge should from time to time make simple tests to ascertain whether the proper flow of air in each stove is duly maintained; for this purpose the Committee recommends that a supply of smoke paper should be kept available.
7. Efficient means of regulating the temperature of the various drying stoves on a pottery are not in all cases available. It is felt that much greater attention should be given to this point. Wherever possible, it is desirable that the sections of a drying stove allocated to different workers should be separated and each provided with its own separate means of heating and ventilation so that these may be under the control of the individual workers.
8. The Committee has been surprised to find in some cases that the elementary principles of ventilation have been overlooked in the design of the ventilating shafts from stoves and workshops; *e.g.*, numerous instances have been noted of branch pipes entering a main duct at right angles (Fig. 1), and that horizontal or nearly horizontal main ducts have been constructed of such length and with such inadequate outlets as to make them very unsuitable for their purpose.
9. Attention should again be drawn to the simple principle that where ducts come together they should be so formed that the flow of air from one duct does not in any way baffle or interfere with the flow of air from the other duct (Fig. 2); this means generally, that all branch pipes should be led into a main duct with a smooth curve in the direction of the flow of air, and the main duct beyond the junction proportionately enlarged (Fig. 3); all bends in a duct should be constructed of as large radius as possible and on the lobster-back principle (Fig. 4); the discharge outlets to the air

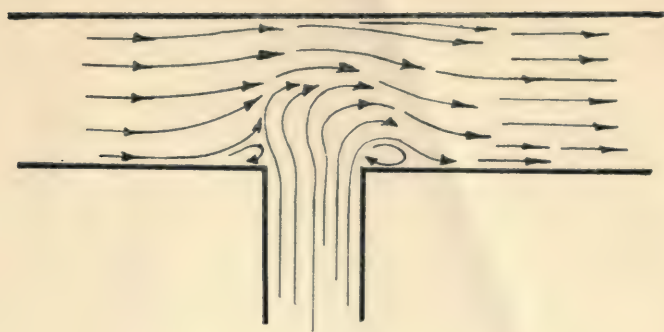


FIGURE. 1.

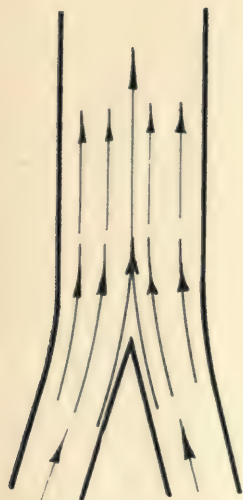


FIGURE. 2.

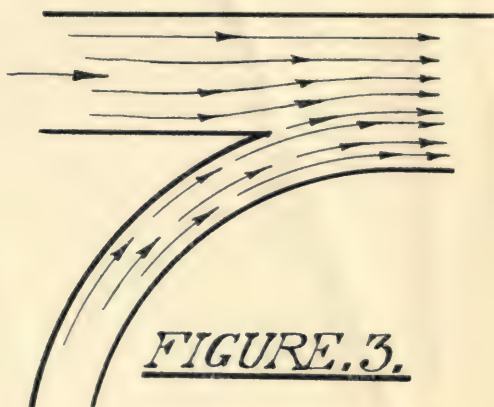


FIGURE. 3.

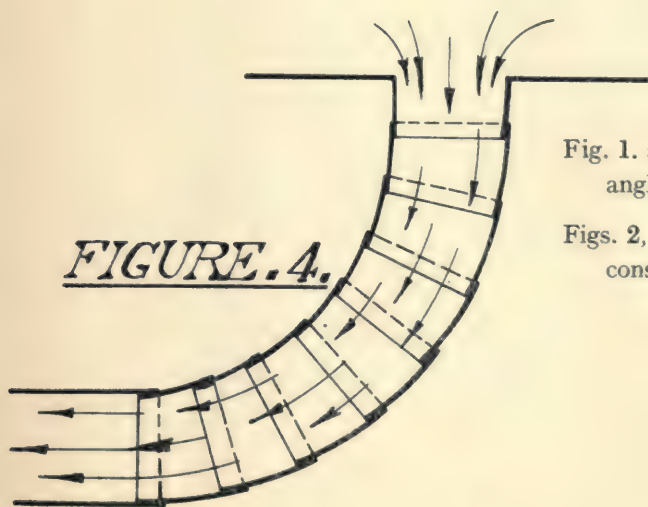


FIGURE. 4.

Fig. 1. shows the baffling at a right angled branch.

Figs. 2, 3, 4, are examples of sound construction.

must in no case provide a smaller area than the total area of the duct.

10. The Committee feels that it is not necessary to modify in any material degree the views expressed in the First Report published in 1920. It should, however, be understood that in paragraph 1 (a) of that Report it is implied that the air should be hot as well as dry; the remarks in paragraph 6 should be taken as applying only in a very limited degree to well-fitted Dobbin Stoves properly maintained, and in paragraph 10 the words "vitiating" and "saturated" were used in a colloquial rather than a technical sense. To avoid any technical misinterpretation, the Committee suggests that the last three lines of that paragraph be read thus:—

"While quantities of *humid* air pour out of such stoves into the workrooms, a great deal of air *highly charged* with moisture collects in the stoves themselves and impedes drying."

11. The Committee feels very strongly that an investigation should be made on strictly scientific lines into the whole problem of the drying of wares of different types and of different thicknesses. Such an investigation should aim at determining the exact conditions of temperature, air movement and ventilation which are BEST at every successive stage in the drying process; whether, for example it is possible, consistently with producing good ware, to bring warm air into direct contact with moulds and ware containing the greatest proportion of moisture, leaving the cooler air to pass on over the moulds and ware which are already nearly dry, or whether it is more conducive to successful manufacturing to warm up the moulds and ware in almost still air and then subject them at a later stage to a relatively faster current of warmer air. These and many other cognate problems can only be settled by careful scientific experiment, and it is felt that such an investigation will amply repay the cost entailed.
12. In the meantime, the Committee would again very strongly urge on the industry the great importance of attention to the questions already raised in these Reports, not only from the point of view of efficiency of manufacture, but also from the point of view of the health of the Pottery worker. To sum up the investigations undertaken so far, the Committee has drawn up a summary in tabular form giving briefly the points for and against the various types of stoves so far investigated.
13. The Committee wishes to acknowledge its indebtedness to the undermentioned firms who kindly permitted an inspection of their drying Stoves and who placed all available information at its disposal:—

Massey & Sons, Newcastle.

Brown & Steventon Ltd., The Royal Pottery, Burslem.

Ford, S. & Co. (Burslem) Ltd., Lincoln and Crown Potteries, Burslem.

Maddock, J. & Sons, Ltd., Newcastle Street and Dalehall.
Burslem.

Wood & Sons, New Wharf Potteries, Burslem.

Myott, Son & Co., Alexander Pottery, Cobridge.

Meakin, J. & G. Ltd., Eagle Pottery, Hanley.

Ashworth, G. L. & Bros., Broad Street, Hanley.

Wedgwood, Josiah, & Sons, Ltd., Etruria.

Swinnertons, Ltd., Hanley.

Jones, A. B. & Sons, Grafton Works, Longton.

Plant, R. H. & S. L. Ltd., Tuscan Works, Longton.

Williamson, H. M. & Sons, Bridge Pottery, Longton.

Lawrence, T., Longton.

Poole, T., Cobden Works, Longton.

Advantages and Objections to various types of Stoves

Advantages.

Objections.

Chamber Stove.	May be used where structural alterations are impossible providing the ventilation is such as to prevent back draught into shop.	(a) Mould capacity low. (b) Back draught into shop causing unnecessarily high temperature and unhealthy humid atmosphere (c) Fatigues mould runner owing to long distance from maker to stove; the mould runner has to enter the stove and in some cases pass over heated steam pipes.
Dobbin Stove.	Heat well confined, if stove is of good design. Very adaptable to various kinds of workshops. Mould capacity good.	Mould runner has to climb steps to reach upper shelves. Not very suitable for large wares.
Leaf Stove.	Mould capacity high, economising space.	Same objections as Chamber Stove except (a).
Draw-out stove.	(a) Mould capacity good. (b) With well-fitted sections, the heat is confined to stove. (c) Very efficient for flat and tea ware	Requires large floor space. Fatigues mould runner owing to the climbing of steps to reach upper shelves; for the Hollow-ware jiggerer this type of stove must be of reasonable height.
Cabinet Stove.	(a) Heat well confined. (b) Very simply constructed and easily kept clean. (c) Workshops easily kept clean. (d) Reduces the fatigue of mould runners.	Mould capacity low. Workshops will require separate heating to make the temperature suitable to the operatives. Not adaptable for large moulds
Mangle Stove.	(a) Heat well confined. (b) Mould capacity good. (c) Easily kept clean. (d) Workshops easily kept clean. (e) Distance from maker to stove reduced to lowest minimum. (f) Revolving shelves always brought to most convenient height for mould runner. (g) Mould runner does not have to enter the stove or climb steps to upper shelves. (h) Mould runner less fatigued and output of maker increased. (i) Messrs. Wood & Goldstraw's type is suitable for large ware and can be adapted for flat and tea ware.	Messrs. Poole's type requires lofty shop, but may be capable of modification to meet requirements of shops with lower roofs.

(The last three types possess the great advantage that the Mould Runner does not have to enter any portion of the heated Chamber).

N.B.—In the case of all stoves it is of the utmost importance that attention should be paid to the construction and arrangement of the ventilating outlets and ducts and particularly to the arrangement of the steam pipes, in such a way that real cleanliness is readily obtainable.

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National Council of the
Pottery Industry
Interim report

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